



Performance of ESG and Machine Learning investment approaches

January 2019

Carmine De Franco, PhD
Head of Fundamental Research
carmine.de-franco@ossiam.com

Executive Summary

ESG integration in investors' portfolios is becoming a market standard. ESG ratings measure the strengths and weaknesses of a company along many specific criteria related to Environmental, Social and Governance issues. Many reasons lie behind this gradual switch, from genuinely motivated investors willing to align their investments to their values, to investors that recognise the reputation risk related to controversial investment practices, finally to investors that recognise the financial risks coming from companies with poor ESG profiles. If investors agree on the usefulness of ESG integration for risk management purposes, there is still no clear consensus about the ability of ESG integration in delivering higher returns. The prevalently negative assessment between Corporate Social Performance (CSP) and Corporate Financial Performance (CFP), in vogue in the '1970 has changed significantly over time, and now the overwhelming majority of empirical research share a clear optimism about the link between CSP and CFP. Although we do not share the most extreme optimism regarding the power of ESG as performance-enhancer, we recognize the connection between economic strength and sustainability from a general perspective. Therefore, if ESG filtering does not bring out-of-sample outperformance, it is not necessarily because ESG information is not relevant. There is indeed no fundamental reason for an aggregated metric such as ESG to deliver consistent outperformance over time. ESG ratings average very diverse indicators and therefore are not well suited to differentiate stocks from different sectors or countries for financial purposes. Knowing if ESG can bring performance is an important issue since both regulation and industry trends are pushing investors towards widespread ESG integration.

In this research note we will show how simple ESG filtering approaches fail to outperform their benchmark, even if we must acknowledge that, overall, they do not bring specific underperformance either. Our results are in line with what investor can achieve by tilting their portfolios towards the best ESG performers: As an example, over the period Dec, 2010 to Dec, 2018, the MSCI World ESG Leaders Net Return USD Index delivered a compounded 71.42%, slightly less than the market benchmark MSCI World Net Return USD Index at 73.19%. Even if the former shows a better ESG profile, ESG itself did not bring any particular performance improvement. Optimistically-minded investors can still see that the gap is very little and worth to pay in order to achieve an improved ESG profile, but this does not dispense us from questioning why. While several motives may operate simultaneously, both the diversity of the investment universe and the lack of granularity in ESG ratings (which are usually used in their aggregated form) represent a challenge from a financial perspective. In other words, the lack of consistent outperformance for simple ESG filtered strategies is due to the difficulty to extract useful information from large and sparse data such as ESG ratings in an efficient way.

In the second part of this note, we explicitly design a machine learning algorithm that enables us to extract useful information from ESG data. More precisely, it identifies strong and consistent patterns between companies' ESG profiles and their expected likelihood to outperform. We finally show how granular ESG information and machine learning provide robust financial signals and how to use them efficiently even in simple investment strategies.

The investment universe considered in this paper is the capitalization-weighted Solactive GBS World Index¹ which includes the largest companies listed in the US, Canada, Western Europe, Japan, Australia, New Zealand, Hong Kong and Singapore, from October 2012 to December 2018. Portfolios are calculated in USD. Stock prices and dividends are taken from Thomson Reuters/Datastream while ESG ratings from Sustainalytics².

ESG Filtering

Building portfolios by filtering out companies with poor ESG ratings is one of the most popular approaches among investors. While this approach is easy to understand and improves the overall ESG profile of the portfolio, it should not be thought of as a way to enhance performance. In order to analyse this topic, we have built three cap-weighted portfolios that consist of companies whose ESG ratings belong to the top tercile among peer groups (hereafter *ESG Top*), to the middle tercile (hereafter *ESG Mid*) and finally to the lowest tercile (hereafter *ESG Low*, the one with the poorest ESG ratings). Figure 1 shows annualised performances, volatilities and Sharpe ratios for these portfolios and the benchmark.

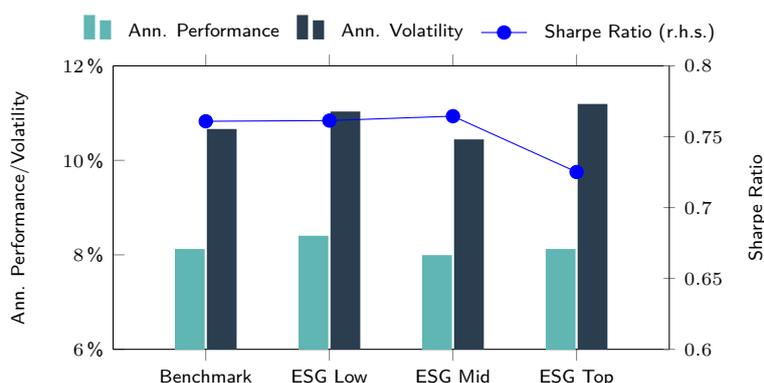


Figure 1: Annualized performances, volatilities and Sharpe ratios for the benchmark and the three portfolios sorted by ESG ratings.

The Best-In-Class filtering approach based on peer groups, i.e. groups of stocks with very similar characteristics and operating in similar businesses, does not alter the economic structure of the initial investment universe. This is because ESG ratings have a structural, sector-driven bias which usually favour specific sectors (e.g. Information Technology or Healthcare) while penalizing others (e.g. Energy or Utilities). For example, this approach makes sure that the portfolio ESG Low does not systematically pick companies from sectors that have structurally lower ESG ratings.

From a simple risk/return perspective it appears that variations in ESG ratings among peer groups are not responsible for changes in performances or risks. Poorly rated ESG companies realize a similar performance, if not higher, compared to the ESG Top portfolio.

The same conclusions can be drawn if we perform the analysis with portfolios ranked according to single Environment (E), Social (S) or Governance (G) ratings, as shown in Figure 2.

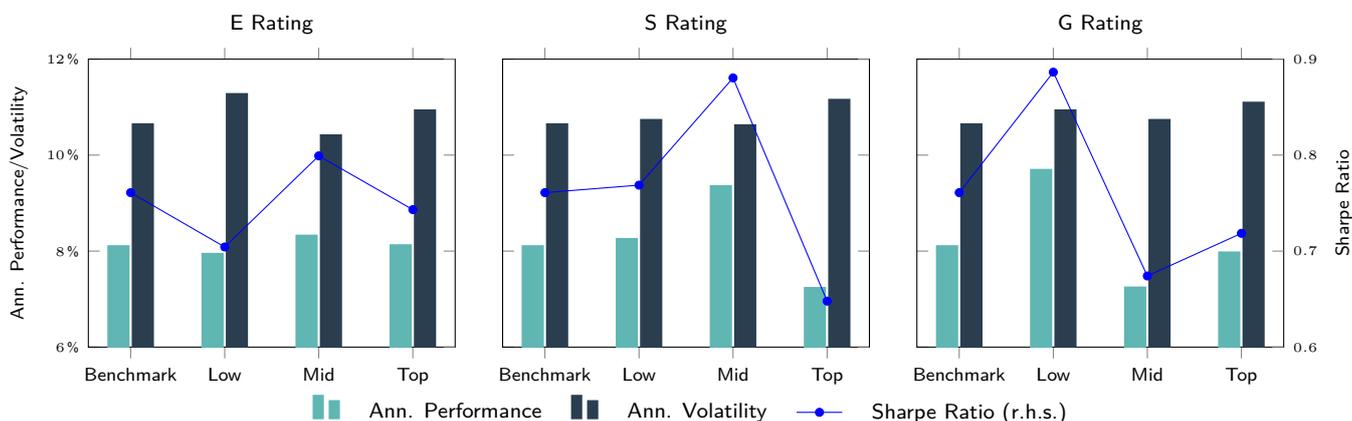


Figure 2: Annualised performances, volatilities and Sharpe ratios for the benchmark and the three portfolios sorted by E (resp. S and G) ratings.

When we narrow our analysis on different regions, the results are more diverse, obviously because we are now exposed to different regional market factors, as illustrated in Figure 3. If volatility-wise we are on similar levels, the performances of the three groups of portfolios are clearly different, with the US based portfolios leading and the European counterparts lagging behind. Nevertheless, the gap in performances between ESG Low and ESG Top portfolios in the three regions are very small. We find small outperformance in top ESG rated European companies compared to poorly rated ones, but this is not verified in the US nor in the Asia Pacific region.

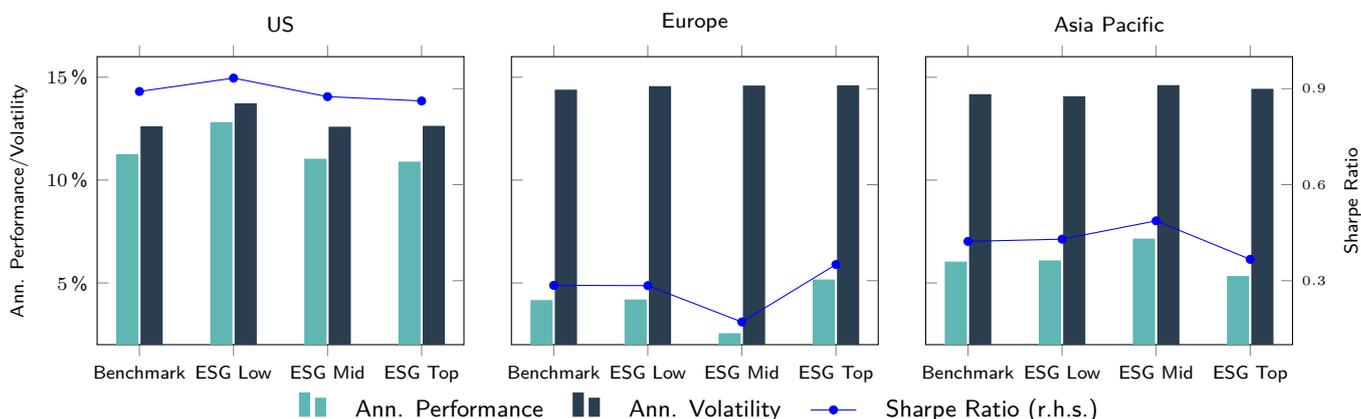


Figure 3: Annualized performances, volatilities and Sharpe ratios for the benchmarks and the three portfolios sorted by ESG ratings relatively to the US, European and Asia-Pacific markets. The benchmarks are cap-weighted regional portfolios derived from the initial global developed benchmark.

Machine Learning

We have seen how simple universe screening by ESG ratings fails to provide significant performance enhancement. More often than not, the lower tercile of the ESG distribution outperforms both the higher tercile and the benchmark. This is not to say that ESG is a persistent drag on performance. Rather, it is the non-homogeneous nature of the investment universe (especially the large global developed) coupled with the loss of information that comes from aggregated ESG ratings to be responsible for such a behaviour. We will show that with a different approach we are able to extract useful information and create financial value from ESG data.

Our Machine Learning (ML) approach relies on the assumption that there is a link between the ESG profile of a company and its economic/financial performance, but this link is not direct nor stable over time, and does not involve all the available ESG data. Stated otherwise, there are possibly few ESG metrics that have a material impact on the financial performance of the company. And the experience tells us that usually there are thresholds in the ESG metrics above which there is no more differentiation among companies (i.e., above a given level on a specific ESG indicator, we cannot say with sufficient accuracy, that company A can outperform company B because A is better rated than B).

The Objective: *The ML objective is to exploit ESG data and find a robust separation of the investment universe in two set; each set is made of stocks that, given their ESG profile, are likely to represent an opportunity (resp. a risk) from a financial perspective.*

The Expert. The core of our ML algorithm is the *expert*. Like a human expert, an expert in the context of ML

- learns from the observations it has access to,
- is characterized by its own knowledge,
- is able to provide an *answer* when asked about the prospect of a company given its ESG profile.

In our specific application, the expert will look at ESG data and uncover a pattern between some ESG metric and financial performance. A simple (but usually not true, as we just saw) pattern would be of the form "... Stocks whose ESG ratings are high outperform their peers...". In this example, the expert observes that, historically, there is a relationship between ESG ratings and performance (the knowledge). When asked about the likelihood for a company to outperform, the expert will look the current ESG rating (profile) of the company and, through its knowledge, it will answer: Yes, No or I don't know.

One expert is usually not enough to determine if a company is an opportunity or a risk. To improve its performance, the ML algorithm will build a *Panel of Experts*, each characterized by its own knowledge. Each expert represents a different pattern. When we ask the panel about the likelihood of a company to be an opportunity (or a risk) the panel put together the answers of its members and give a final answer of the form: Yes, No or I don't know.

The final decision will account for the majority of the panel so that the use of many experts produces better-informed decisions and more robust answers. Over time, the ML lets the experts evolve, eventually by replacing some of them with new ones.

This could be thought as an economic advisory board. The board is made of many experts, each of them specialized in a field and able to provide useful insights on a given economic issue.

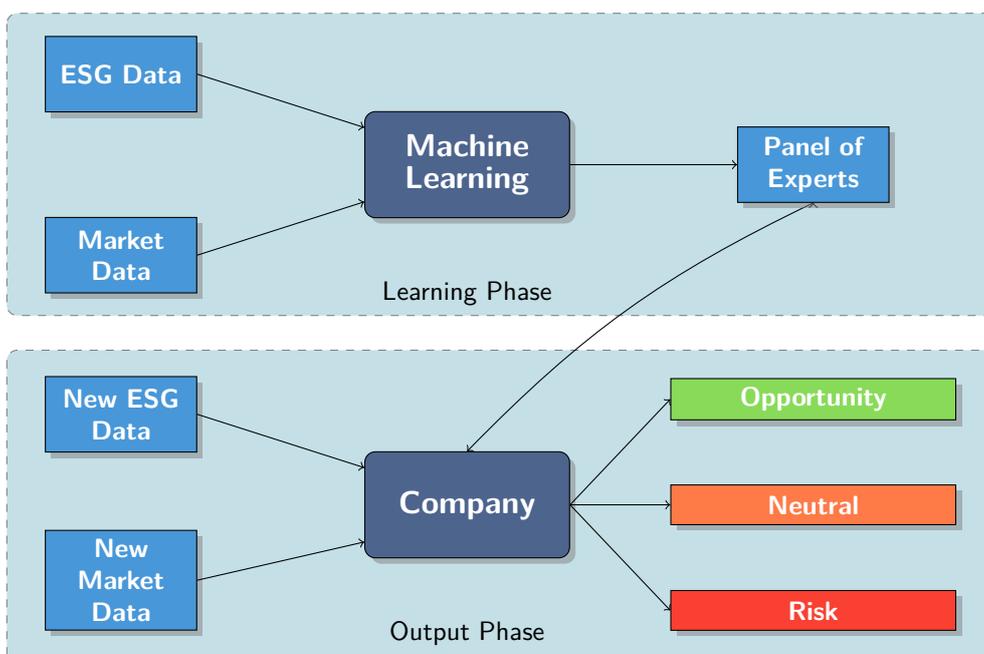


Figure 4: Schematic diagram of the Machine Learning algorithm.

Figure 4 shows the two-step algorithm. In the learning phase, the ML works with the ESG data to uncover patterns and build the panel of experts. In the output phase, for a given company in the investment universe, we use the related ESG data of the company (that the ML has not previously seen) as well as other market data. The panel of experts uses this data and produces a final assessment of the likelihood the company has to outperform the benchmark, given its ESG

and market profile. For example, a company is labelled as Risk if a statistically significant majority of experts has given a negative assessment on its financial prospects. The Neutral label corresponds to the *I don't know* answer, which is common in finance where signals may be contradictory and a clear assessment cannot be done.

Building the panel of experts is the most challenging and complex part of the ML algorithm. Indeed we must find the right ESG variables defining the experts, the thresholds (which represent the knowledge) and the outputs (which represent the experts' answers). And, more importantly, the ML needs to determine how many experts it must retain and how to discriminate among them.

With respect to the simple ESG screening, where one first aggregates all the metrics into one ESG rating and then looks at patterns between ESG ratings and financial performance, in our case we take the opposite way: We look at patterns in the granular ESG metrics and we then aggregate the answers.

Our approach therefore selects material ESG metrics through the definition of the experts, and can easily replicate non-linearities in the relationship between ESG data and financial performance. Indeed, we would not expect to find experts based on ESG indicators that have no material impact on performance, while these indicators will always appear in the aggregated ESG rating, making them very inefficient and noisy for performance enhancement.

Machine Learning and application to investment strategy design

To test the power of the selection process performed by the ML, we design a very simple strategy that screens the investment universe for all stocks labelled as Opportunity (hereafter *ML Opportunity*) while keeping the capitalization-weight allocation. We also consider the portfolio made of excluded stocks, labelled as Neutral or Risk (hereafter *ML Risk*) where again each stock is weighted by its market capitalization.

Figure 5 shows the annualised performances, volatilities and Sharpe ratios for the two ML portfolios together with the benchmark and the ESG screened portfolios.

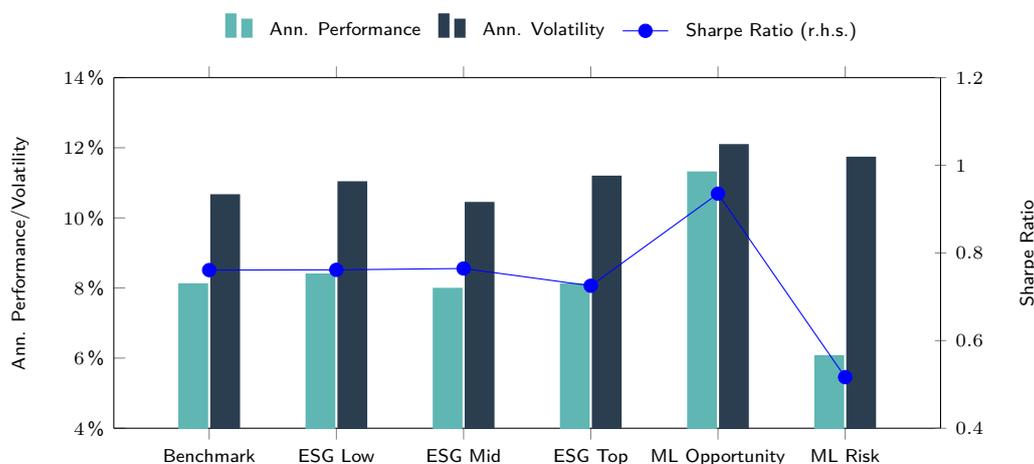


Figure 5: Annualized performances, volatilities and Sharpe ratios for the benchmark, ML Opportunity and ML Risk portfolios and the three portfolios sorted by ESG ratings and the Machine-Learning portfolios.

We observe a significant increase in the out-of-sample performance of ML Opportunity portfolio compared to the benchmark, the three ESG sorted portfolios and the ML Risk portfolio, which shows the lowest performance. More precisely, over the period the ML Opportunity portfolio realizes an annualised performance of 11.2% compared to 8.09% for the benchmark and 6.04% for the ML Risk portfolio.

Clearly the ML algorithm has been able to efficiently separate the investment universe between Opportunity stocks and Risk stocks. Even with a standard portfolio construction (here cap-weighted) we can assess the efficiency and the power of ML techniques when it comes to detect signals from sparse but rich ESG data.

Figure 6 highlights the historical performances of both ML Opportunity and ML Risk portfolios (left) and the relative strength ratio of the ML Opportunity portfolio over the benchmark (right) that shows how the ML Opportunity portfolio adds sizeable value over time.

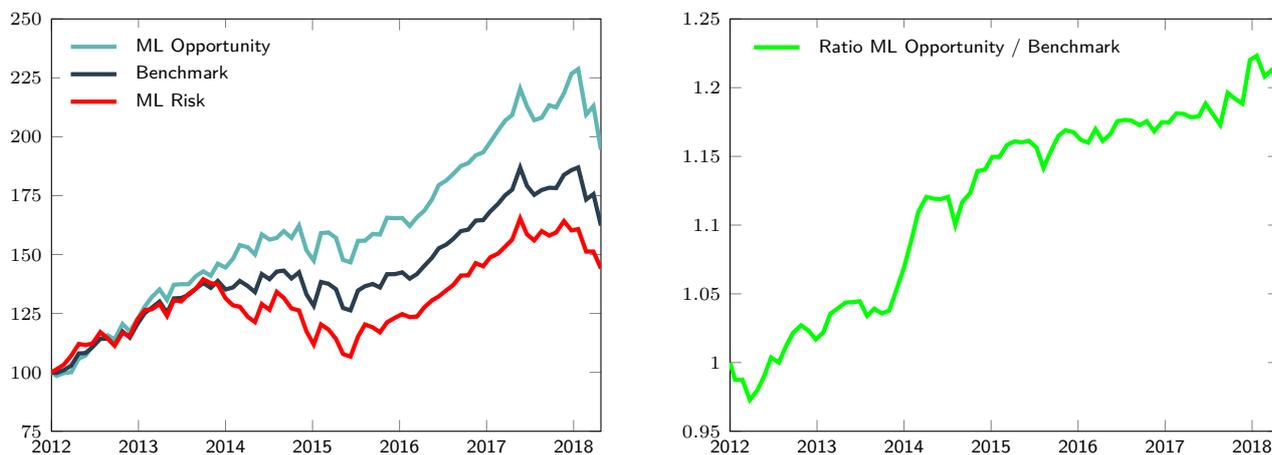


Figure 6: Left: Historical portfolio levels for the benchmark, the ML Opportunity and ML Risk portfolios. Right: the relative strength ratio between the ML Opportunity portfolio and the benchmark.

Finally, Figure 7 shows performances, volatilities and maximum drawdowns for three variations of the ML-based portfolios. More precisely, we select stocks by separating Opportunities from Risks based on the ML screening, but we weight them to match size, sector or country exposures, to ensure that all the performance comes only from the picking ability of the ML rather than from unwanted or unexpected style exposures.

The ML Opportunity portfolio outperforms the ML Risk portfolio, whether we match the size, the sector or the country exposures. The gaps in annualised performance are roughly 6% and stable across the three different versions. More interestingly, the maximum drawdowns of the ML Risk portfolios are systematically higher. This is another out-of-sample confirmation of the ML's ability to extract useful information for ESG data, especially by avoiding companies that represent sizeable idiosyncratic risks in the portfolio.

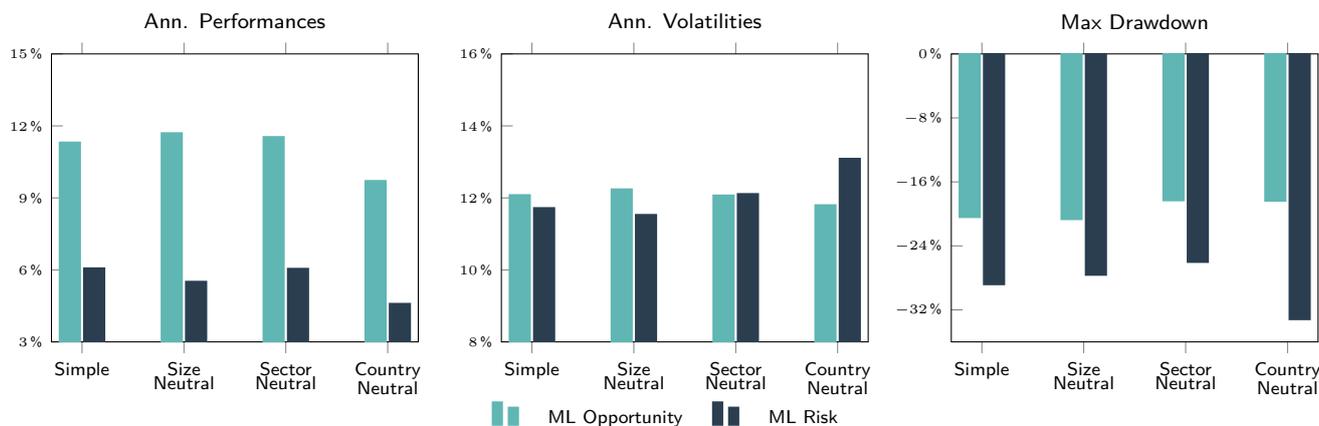


Figure 7: Annualised performances, volatilities and maximum drawdowns for the ML Opportunity portfolio and the ML Risk portfolios where the implementation is done by matching size, sector or country exposures.

Conclusion

Global interest in ESG investment solutions has been soaring in the last couple of years. But investors should be aware that filtering and selecting top ESG rated companies is not necessarily a way to enhance returns. Indeed, in many occasions, the opposite turns out to be true. One of the main factors behind this underperformance is that ESG ratings are aggregated scores that miss significant pieces of information regarding the strengths and weaknesses of companies. They also systematically underweight those indicators that could potentially have an impact on their business models. As ESG will become more integrated in the portfolio construction process, there is no doubt that it will play a significant role in stocks' returns.

To exploit valuable ESG data, we have designed a Machine Learning algorithm that, through the intermediation of a Panel of Experts, identifies ESG patterns and profiles related to financial performance. Our Machine Learning algorithm exploits granular and derived variables from ESG data sets and is able to select what is really material for companies from an ESG perspective.

We test our algorithm with simple investment strategies and show how it is possible to complement financial objectives with ESG integration, by delivering significantly better financial results. We finally show that this significant improvement is not due to unexpected style exposures. It is instead the result of an efficient use of powerful innovative techniques.

Notes

¹The data relative to the investment universe is a courtesy of Solactive (hereafter the *Benchmark*) and is related to the Global Benchmark Series (GBS) that the index provider recently launched.

²The ESG data is a courtesy of Sustainalytics, a leading provider in ESG research and analytics.

Disclaimer

This document is not of a regulatory nature and has been provided for information purposes only to Qualified Investors. Ossiam, a subsidiary of Natixis Investment Managers, is a French asset manager authorized by the Autorité des Marchés Financiers (Agreement No. GP-10000016). Although information contained herein is from sources believed to be reliable, Ossiam makes no representation or warranty regarding the accuracy of any information of which it is not the source. The information presented in this document is based on market data at a given moment and may change from time to time. This material has been prepared solely for informational purposes only and it is not intended to be and should not be considered as an offer, or a solicitation of an offer, or an invitation or a personal recommendation to buy or sell participating shares in any Ossiam Fund, or any security or financial instrument, or to participate in any investment strategy, directly or indirectly. It is intended for use only by those recipients to whom it is made directly available by Ossiam. Ossiam will not treat recipients of this material as its clients by virtue of their receiving this material. All performance information set forth herein is based on historical data and, in some cases, hypothetical data, and may reflect certain assumptions with respect to fees, expenses, taxes, capital charges, allocations and other factors that affect the computation of the returns. Past performance is not necessarily a guide to future performance. Any opinions expressed herein are statements of our judgement on this date and are subject to change without notice. Ossiam assume no fiduciary responsibility or liability for any consequences, financial or otherwise, arising from, an investment in any security or financial instrument described herein or in any other security, or from the implementation of any investment strategy. This information contained herein is not intended for distribution to, or use by, any person or entity in any country or jurisdiction where to do so would be contrary to law or regulation or which would subject Ossiam to any registration requirements in these jurisdictions. This material may not be distributed, published, or reproduced, in whole or in part.

Additional Note

This material has been provided for information purposes only to investment service providers or other Professional Clients, Qualified or Institutional Investors and, when required by local regulation, only at their written request. This material must not be used with Retail Investors.

In the E.U. (outside of the UK and France): Provided by Natixis Investment Managers S.A. or one of its branch offices listed below. Natixis Investment Managers S.A. is a Luxembourg management company that is authorized by the Commission de Surveillance du Secteur Financier and is incorporated under Luxembourg laws and registered under n. B 115843. Registered office of Natixis Investment Managers S.A.: 2, rue Jean Monnet, L-2180 Luxembourg, Grand Duchy of Luxembourg. **Italy:** Natixis Investment Managers S.A., Succursale Italiana (Bank of Italy Register of Italian Asset Management Companies no 23458.3). Registered office: Via Larga, 2 - 20122, Milan, Italy. **Germany:** Natixis Investment Managers S.A., Zweigniederlassung Deutschland (Registration number: HRB 88541). Registered office: Im Trutz Frankfurt 55, Westend Carrée, 7. Floor, Frankfurt am Main 60322, Germany. **Netherlands:** Natixis Investment Managers, Nederlands (Registration number 50774670). Registered office: Stadsplateau 7, 3521AZ Utrecht, the Netherlands. **Sweden:** Natixis Investment Managers, Nordics Filial (Registration number 516405-9601 - Swedish Companies Registration Office). Registered office: Kungsgatan 48 5tr, Stockholm 111 35, Sweden. **Spain:** Natixis Investment Managers, Sucursal en España. Serrano n.90, 6th Floor, 28006, Madrid, Spain.

In France: Provided by Natixis Investment Managers International – a portfolio management company authorized by the Autorité des Marchés Financiers (French Financial Markets Authority - AMF) under no. GP 90-009, and a public limited company (société anonyme) registered in the Paris Trade and Companies Register under no. 329 450 738. Registered office: 43 avenue Pierre Mendès France, 75013 Paris.

In Switzerland: Provided for information purposes only by Natixis Investment Managers, Switzerland Sàrl, Rue du Vieux Collège 10, 1204 Geneva, Switzerland or its representative office in Zurich, Schweizergasse 6, 8001 Zurich.

In the U.K.: Provided by Natixis Investment Managers UK Limited which is authorised and regulated by the UK Financial Conduct Authority (register no. 190258). This material is intended to be communicated to and/or directed at persons (1) in the United Kingdom, and should not to be regarded as an offer to buy or sell, or the solicitation of any offer to buy or sell securities in any other jurisdiction than the United Kingdom; and (2) who are authorised under the Financial Services and Markets Act 2000 (FSMA 2000); or are high net worth businesses with called up share capital or net assets of at least £5 million or in the case of a trust assets of at least £10 million; or any other person to whom the material may otherwise lawfully be distributed in accordance with the FSMA 2000 (Financial Promotion) Order 2005 or the FSMA 2000 (Promotion of Collective Investment Schemes) (Exemptions) Order 2001 (the "Intended Recipients"). The fund, services or opinions referred to in this material are only available to the Intended Recipients and this material must not be relied nor acted upon by any other persons. Registered Office: Natixis Investment Managers UK Limited, One Carter Lane, London, EC4V 5ER.

In the DIFC: Provided in and from the DIFC financial district by Natixis Investment Managers Middle East (DIFC Branch) which is regulated by the DFSA. Related financial products or services are only available to persons who have sufficient financial experience and understanding to participate in financial markets within the DIFC, and qualify as Professional Clients as defined by the DFSA. Registered office: Office 603 - Level 6, Currency House Tower 2, PO Box 118257, DIFC, Dubai, United Arab Emirates.

In Japan: Provided by Natixis Investment Managers Japan Co., Ltd., Registration No.: Director-General of the Kanto Local Financial Bureau (kinsho) No. 425. Content of Business: The Company conducts discretionary asset management business and investment advisory and agency business as a Financial Instruments Business Operator. Registered address: 1-4-5, Roppongi, Minato-ku, Tokyo.

In Taiwan: Provided by Natixis Investment Managers Securities Investment Consulting (Taipei) Co., Ltd., a Securities Investment Consulting Enterprise regulated by the Financial Supervisory Commission of the R.O.C. Registered address: 34F., No. 68, Sec. 5, Zhongxiao East Road, Xinyi Dist., Taipei City 11065, Taiwan (R.O.C.), license number 2018 FSC SICE No. 024, Tel. +886 2 8789 2788.

In Singapore: Provided by Natixis Investment Managers Singapore (name registration no. 53102724D) to distributors and institutional investors for informational purposes only. Natixis Investment Managers Singapore is a division of Ostrum Asset Management Asia Limited (company registration no. 199801044D). Registered address of Natixis Investment Managers Singapore: 5 Shenton Way, 22-05 UIC Building, Singapore 068808.

In Hong Kong: Provided by Natixis Investment Managers Hong Kong Limited to institutional/ corporate professional investors only.

In Australia: Provided by Natixis Investment Managers Australia Pty Limited (ABN 60 088 786 289) (AFSL No. 246830) and is intended for the general information of financial advisers and wholesale clients only.

In New Zealand: This document is intended for the general information of New Zealand wholesale investors only and does not constitute financial advice. This is not a regulated offer for the purposes of the Financial Markets Conduct Act 2013 (FMCA) and is only available to New Zealand investors who have certified that they meet the requirements in the FMCA for wholesale investors. Natixis Investment Managers Australia Pty Limited is not a registered financial service provider in New Zealand.

In Latin America: Provided by Natixis Investment Managers S.A.

In Uruguay: Provided by Natixis Investment Managers Uruguay S.A., a duly registered investment advisor, authorised and supervised by the Central Bank of Uruguay. Office: San Lucar 1491, oficina 102B, Montevideo, Uruguay, CP 11500. The sale or offer of any units of a fund qualifies as a private placement pursuant to section 2 of Uruguayan law 18,627.

In Colombia: Provided by Natixis Investment Managers S.A. Oficina de Representación (Colombia) to professional clients for informational purposes only as permitted under Decree 2555 of 2010. Any products, services or investments referred to herein are rendered exclusively outside of Colombia. This material does not constitute a public offering in Colombia and is addressed to less than 100 specifically identified investors.

In Mexico: Provided by Natixis IM Mexico, S. de R.L. de C.V., which is not a regulated financial entity or an investment manager in terms of the Mexican Securities Market Law (Ley del Mercado de Valores) and is not registered with the Comisión Nacional Bancaria y de Valores (CNBV) or any other Mexican authority. Any products, services or investments referred to herein that require authorization or license are rendered exclusively outside of Mexico. Natixis Investment Managers is an entity organized under the laws of France and is not authorized by or registered with the CNBV or any other Mexican authority to operate within Mexico as an investment manager in terms of the Mexican Securities Market Law (Ley del Mercado de Valores).

Any use of the expression or reference contained herein to "Investment Managers" is made to Natixis Investment Managers and/or any of the investment management subsidiaries of Natixis Investment Managers, which are also not authorized by or registered with the CNBV or any other Mexican authority to operate within Mexico as investment managers. The above referenced entities are business development units of Natixis Investment Managers, the holding company of a diverse line-up of specialised investment management and distribution entities worldwide. The investment management subsidiaries of Natixis Investment Managers conduct any regulated activities only in and from the jurisdictions in which they are licensed or authorized. Their services and the products they manage are not available to all investors in all jurisdictions. It is the responsibility of each investment service provider to ensure that the offering or sale of fund shares or third party investment services to its clients complies with the relevant national law. The provision of this material and/or reference to specific securities, sectors, or markets within this material does not constitute investment advice, or a recommendation or an offer to buy or to sell any security, or an offer of any regulated financial activity. Investors should consider the investment objectives, risks and expenses of any investment carefully before investing. The analyses, opinions, and certain of the investment themes and processes referenced herein represent the views of the portfolio manager(s) as of the date indicated. These, as well as the portfolio holdings and characteristics shown, are subject to change. There can be no assurance that developments will transpire as may be forecasted in this material. Past performance information presented is not indicative of future performance. Although Natixis Investment Managers believes the information provided in this material to be reliable, including that from third party sources, it does not guarantee the accuracy, adequacy, or completeness of such information. This material may not be distributed, published, or reproduced, in whole or in part. All amounts shown are expressed in USD unless otherwise indicated.